What 1 KWH will do.

UNITED STATES DEPARTMENT OF AGRICULTURE
RURAL ELECTRIFICATION ADMINISTRATION
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To: Regional and Section Heads and Field Representatives

From: C. O. Falkenwald, Chief
Applications and Loans Division

Subject: Kilowatt Hours and the Manpower Shortage

The attached information will be useful to you in discussing the place of rural electrification in the alleviation of the manpower shortage.

You will note that these specific examples are in the form of direct quotations from various experiment stations or state universities.

If you should happen to find additional examples similar to these listed here, I shall appreciate your bringing them to my attention.

Attachment

# THE POWER OF 1 KWH

1 KWH = 1 man-day labor )
1 KWH = 1 pound of coal ) in terms of physical energy.
1 KWH = 1/10 gallon fuel oil )

## WHAT 1 KWH WILL DO:

### In the Farm Home

1. Wash 1 large weekly wash.
2. Iron for 2 hours.
3. Run Refrigerator for 15 hours.
4. Light House for over 1 hour.
5. Run Radio for 15 hours.
6. Operate Vacuum Cleaner for 3 hours.
7. Cook 4 Farm Meals on electric range.
8. Run Sewing Machine 8 hours.
9. Tell Time for 20 days.
10. Toast Bread for 8 mornings.
11. Make the Coffee 3 meals a day for 4 days.
12. Operate Kitchen Mixer for 20 hours.
13. Run 6" fan for 50 hours.
14. Heat Pad for 15 hours.
15. Heat Curling Iron for 42 hours.
16. Operate Radiant Heater for 2 hours.
17. Make Ice Cream 10 batches.
18. Run Kitchen Exhaust Fan 5 hours.
19. Operate Sun Lamp for 1-2/3 hours.
20. Make 30 waffles.
21. Operate Razor Blade Sharpener for 40 hours.
22. Run Electric Razor for 15 days.
23. Run coal stoker to burn 1/4 ton of coal.
24. Run Dishwasher for 2½ days.

### On the Farm

1. Operate Barn Ventilator for 12 days.
2. Milk 30 cows.
3. Wash 2,000 bottles.
4. Churn 67 pounds of butter.
5. Clip horses or cows 10 hours.
6. Heat 5 gallons water.
7. Cut 1 ton ensilage and put it in a 30' silo.
8. Charge electric fence 4 days.
9. Grind 200 bushels of grain.
10. Bale 800 pounds of hay.
11. Elevate 250 pounds of grain.
12. Incubate 25 eggs.
13. Light poultry house 6 days.
14. Shear 50 sheep.
15. Thresh 8 bushels of grain.
16. Operate tool grinder for 4 hours.
17. Pump 1,000 gallons of water from shallow well.
18. Saw 1 cord of wood.
19. Separate cream from 2,000 pounds of milk.
20. Shell 30 bushels of corn.
21. Raise in brooder 2 chicks.
22. Run Water Pump for 3 hours.
23. Operate Milk Cooler and cool 10 gallons of milk.
24. Candle eggs for 40 hours.
25. Grind 250 pounds of meat.
26. Sharpen 50 axes.
27. Operate 2 square yards hot bed, 24 hours with outside temperature 40°.
28. Operate 1/4 HP utility motor for 5½ hours.
29. Run hedge-trimmer for 5 hours.
30. Operate lawn mower for 5½ hours.
31. Clean and Grade 100 bushels of small grain.
32. Irrigate from 10' lift.
33. Light entire farmstead for 24 hours.
34. Operate Ultra-Violet poultry lamp 24 hours.
35. Sterilize 1 cubic foot soil.
36. Furnish 1½ days' water supply entire farm.

# THE POWER OF 1 KWH

In this critical moment of man-power shortage, it is time to re-examine the power of 1 KWH of electrical energy. It has been pointed out that 1 KWH equals 1 man-day's labor, or one pound of coal, or one-tenth gallon of fuel oil, in terms of physical energy. It has long been known that kilowatt hours replace man hours with great economy and greater efficiency. Numerous publications of Land Grant Colleges and Research Agencies have uncovered this seldom recognized, but highly significant fact.

Frank J. Zink, Associate Professor of Agricultural Engineering, Kansas State College, has stated succinctly, "Man labor is commonly evaluated at one-tenth of a horse-power during a ten-hour day. Estimating labor at $3.00 per day, one horse-power hour as developed by a man, therefore, costs about $3.00. A one-fourth horse-power motor will do the same amount of work in four hours . . ." Frank J. Zink, "Electric Motors for the Farm", Extension Bulletin 69, Kansas State College, Manhattan (May, 1931) p. 1.

The following statements are excerpts from research publications in the field of rural electrification: The source is given immediately following the quotation.

"The acute shortage of farm labor makes the use of electric motors more important than ever." I. P. Blauser, "Care of Electric Motors", Extension Service, R. E. Circular 41, Ohio State University, Columbus, Ohio, p. 1.

"There has been a decidedly increased interest in hay hoists this year, because of labor shortage. In many cases their use will save the time of one man, woman, or boy in hoisting hay. Also it will release the team or tractor for other work, or will save the time required to change the horse or team from the wagon to the hay rope. The time actually required to do the unloading is less than with a team." I. P. Blauser, "Electric Hay Hoists", Extension Service, R. E. Circular 38, Ohio State University, Columbus, Ohio, p. 1.

"Where electric energy is available for farm use, it is possible and highly practical to do many of the farm tasks with smaller power units and less expensive equipment than formerly were required. A good illustration of this principle is the simple home-made elevator and the small burr mill feed grinder, (Fig. 1). The elevator can be constructed at a cost for material of twenty dollars or less. The burr mill is a standard commercial product selling under eight dollars. The elevator will elevate at the rate of 300 bushels per hour; 500 bushels per kilowatt hour. The mill will grind at the rate of 200 pounds per hour; one ton per 12 kilowatt hours. A one-half h.p. electric motor is ample power for either job." H. J. Gallagher, "Grinding and Elevating Grain with One-Half H.P.

Motor", Extension Service, Extension Bulletin No. 129, Michigan State College, East Lansing, (February, 1933) p. 1.

"With electricity at the rate of 5 cents per K.W.H., a man or woman would earn only 1/4 to 1 cent per hour by doing the work by hand that might be done with an electric motor." I. P. Blauser, "Small Electric Motors", Extension Service, R. E. Circular 5, Ohio State University, Columbus, Ohio, p. 1.

Example 1. - "A one-half horsepower electric motor pumped water on one farm for a year. The well, a shallow one, was approximately 20 feet deep. The total energy used by this pump was 108 K. W. Hrs. The amount of stock on the farm when the stock survey was made was 20 head of cows, 8 head of horses, and 50 head of hogs." (See also examples 2 to 8 inclusive) R. L. Patty, "A Year's Progress with South Dakota's Farm Electric Test Line", Extension Service, Extension Circular 232, South Dakota State College of Agriculture, Brookings, (December, 1925) p. 15.

"Actual studies show that the average American farm wife carries 20 tons of water each year and takes over 200,000 steps doing the task. This means an equivalent of 30 eight-hour days spent each year just carrying water. In many cases this same job is being done by an electric pump at less than one cent a day, or about $3.50 a year, for operating costs." E. T. Swink, "An Electric Water System For the Farm", Extension Division, Circular E-324, Virginia Agricultural and Mechanical College, Blacksburg, (March, 1940) p. 3.

"Farm records show that the consumption of water in the home increases from about 1000 gallons per month, when it is pumped and carried by hand, to 4000 gallons or more per month when water is available at the turn of a faucet. The 4000 gallons of water per month, used in the average home for all purposes, including kitchen, laundry, bath and toilet facilities, can be pumped and delivered where it is needed for about 5 K.W.H., giving a monthly power cost of 25¢ with electricity at 5¢ per K.W.H." I. P. Blauser, "Running Water a Farm Necessity", Extension Service, R. E. Circular 1, Ohio State University, Columbus, Ohio, p. 1.

"Such equipment, of course, eliminates a lot of drudgery. A saving of 50 per cent in the labor requirements for milking represents a reduction of 25 per cent in the total cost of milk production, milking requiring 41 per cent of the total labor. A report from A. and M. College of Texas, shows, on a basis of a 100-cow herd, a net saving of 600 man-hours per month for machine as compared to hand milking. An average of 20 cows were milked per man-hour. On the five Texas farms of varying sizes where these

data were available, from 13 to 28 (or an average of 20) cows were milked per man-hour." (See also Table 38, Effect of Size and Production of Herd on Labor Efficiency, p. 95) "Electricity on the Farm and in Rural Communities" (Revised Edition), C. R. E. A. Bulletin Vol. VII, No. 1, Committee on the Relation of Electricity to Agriculture, Chicago (November, 1931), pp. 94 - 95.

"In terms of operating costs of an electric refrigerator, all these satisfactions may be had with the use of about 30 to 40 K.W.H. per month . . ." Thelma Beall, "A Refrigerator for the Farm Home", R. E. Circular 2, Ohio State University, Columbus, p. 1.

"The average kilowatt hour consumption of electric refrigerators for average household use is approximately 40 per month." Ruth Beard, "Buy Your Automatic Refrigerator with Dollars and Sense", Extension Service, Extension Bulletin 166, Ohio State University, Columbus, (September, 1937) p. 5.

"A milking machine reduces the labor of milking about 50 per cent," I. P. Blauser, "Electric Milking Machines", Extension Service R. E. Circular 12, Ohio State University, Columbus, p. 1.

"A motor operated batch feed mixer on a New Jersey dairy farm which saves the time of one man and mixes and delivers to bags 1500 pounds of mixed feed in 7 minutes." "Electricity on the Farm and in Rural Communities", op. cit., p. 116.

"Grain and corn elevators save a lot of hard work at slight cost. . . . A Nebraska farmer, when he found how little the electricity cost to put his corn in the crib remarked, 'Why, that will hardly pay for the wear and tear on a scoop shovel'. Binning barley directly from the thresher with a saving of 3 or 4 men's labor as compared to hand methods. This type of elevator is also commonly used for cribbing corn." "Electricity on the Farm and in Rural Communities", Ibid., p. 163.

"Progressive farmers are continually looking for better, easier, or cheaper methods of doing their farm work." I. P. Blauser, "Electric Power for Silo Filling", Extension Service, R. E. Circular 17, Ohio State University, Columbus, p. 1.

"The annual average power requirement to cool 100 pounds of milk below 50° F. in an insulated-tank type cooler is approximately 1 kilowatt-hour."

F. E. Price, C. J. Hurd, and G. V. Copson, "Mechanical Refrigeration of Milk in a Tank Type Refrigerator", Oregon Agricultural Experiment Station, Station Bulletin 268, Oregon State Agricultural College, Corvallis, (June, 1930) p. 4.

"Depending upon the skill of the operator, an electric ironing machine saves from one-third to one-half the time required for ironing with hand electric irons." H. S. Hinrichs, "The Use of Electricity on Kansas Farms", Engineering Experiment Station, Bulletin No. 21, Vol. XII, Number 6, Kansas State Agricultural College, Manhattan, (April 15, 1928) p. 61.

"The average kilowatt-hour consumption of electrically operated power ironers is 125 per year. This would be about 10.4 kilowatt hours per month. At the rate of 5 cents per kilowatt hour, the operating cost would be 52 cents per month." Ruth Beard and Thelma Beall, "Are You Buying an Electric Power Ironer?", Extension Service, Bulletin No. 179, Ohio State University, Columbus, (January, 1938) p. 3.

"Milking machines have a high rating in the food production program." I. P. Blauser, "Care of the Milking Machine", Extension Service, R. E. Circular 43, Ohio State University, Columbus, p. 1.

"In our 'Food for Victory' program, the importance of an adequate supply of vegetables is not being overlooked. . . ., A well constructed 6'x6' electric hotbed will use from 1 to 3 KWH per 3'x6' sash per day, depending upon the outside temperature, the construction of the bed, the protection given at night, and the temperature maintained in the bed." I. P. Blauser, "Electric Hotbeds", Extension Service, R. E. Circular 36, Ohio State University, Columbus, p. 1.

"The amount of current used per month by a washing machine is hardly worth mentioning for it is approximately only two kilowatt hours." Thelma Beall, "The Electric Washing Machine", Extension Service, R. E. Circular 20, Ohio State University, Columbus, p. 1.

"Have you ever wished that you had an extra arm to use in mixing cakes, beating candy, and whipping potatoes? If so, an electric mixer might serve as one in these various operations, and it does eliminate that ache in the arm which comes from continued beating and stirring. . . . A mixer consumes very little electricity, about 1/8 K.W.H. per hour of use, depending on the motor rating." Thelma Beall, "The Electric Mixer", Extension Service, R. E. Circular 18, Ohio State University, Columbus, p. 1.

"Ironing time for a family wash can be cut from a fourth, or a third, or even a half, and that means that an ironing machine really reduces ironing time considerably. So there you have reduced two things - ironing time and muscle work." Thelma Beall, "The Electric Ironer", Extension Service, R. E. Circular 11, Ohio State University, Columbus, p. 1.

"The average farm family spends the equivalent of 30 eight-hour days each year carrying 20 to 30 tons of water for kitchen use only. Add to this 20 large buckets on washday, and the requirements for livestock, and one can comprehend the magnitude of this task. Yet, for only two cents per day for electricity this drudgery can be eliminated and the home and farm can be supplied with an abundance of water under pressure." M. M. Johns, "Electric Water Systems for the Farm", Extension Service Publication 260, University of Tennessee, Knoxville, (April, 1942) p. 1.

"There is probably no other piece of equipment on the farm that saves as much labor for so small a cost as does the automatic electric water system. With the present labor shortage, this saving of labor is now doubly important. . . . The automatic electric water system pumps and delivers the water where it is used at a total cost of about 1/2 cent per 100 gallons. In return for working for this low rate, the water system demands a minimum of attention." I. P. Blauser, "Servicing the Electric Water System", Extension Service, R. E. Circular 45, Ohio State University, Columbus, p. 1.

"Grinding and mixing feed on the farm has the advantage of saving time, labor, and expense, of encouraging greater use of home grown feeds, and of quickly and easily changing feed formulas to meet changing conditions. Also, there needs to be no large stock of prepared feed on hand at any one time, with the possibility of deterioration. At this time farmers need to look to the conservation of man power and to the most efficient use of crops produced on their farms. . . . The amount of electricity used for mixing feed is very small, averaging only about 1/2 K.W.H. per ton of feed mixed." I. P. Blauser, "Electrically Driven Feed Mixers", Extension Service, R. E. Circular 32, Ohio State University, Columbus, p. 1.

"Four home electric refrigerators used an average of 379 kilowatt hours of electricity for one year. At 3 cents per K. W. H. the electricity cost the owners $11.91. Three of these were turned off during the winter." Ralph L. Patty, "Cost of Electricity for the Home Electric Refrigerator", Experiment Station, Bulletin 241, South Dakota Agricultural Experiment Station, Brookings, (June, 1929) p. 1.

Dropping Board Cleaning with an Electric Motor, "Cleaning with this equipment takes only a few minutes as compared to an hour or so by the old

method. When it is remembered that many poultrymen clean their houses two or three times per week it becomes apparent that such an arrangement will save an immense amount of labor. A Michigan farmer cleans his dropping boards (30 feet long by 5 feet wide) in a 200-hen house with a motor operated scraper formed of angle irons attached to common chains moving at the rate of 40 feet per minute, the scrapers working with fair satisfaction even when the boards are very dirty or the droppings frozen fast. The motor has a rating of 1/4 hp. and normal speed of 1750 r.p.m. is reduced by an ordinary pump jack. By putting a cart at the conveyor discharge (discharge outside the house) all hand labor up to the point of unloading is eliminated." "Electricity on the Farm and in Rural Communities", Ibid., p. 199.

"Nearly every farm family raises some poultry, and thus practically every farm getting electric service may be considered as a probable user of an electric brooder, regardless of whether 50 or 5,000 chicks or poults are to be brooded. . . . Little time is required to install and adjust." I. P. Blauser, "Electric Brooders", Extension Service, R. E. Circular 10, Ohio State University, Columbus, p. 1.

"Shearing sheep with motor driven shears . . . In some tests at the Oregon Agricultural College it took about 8 minutes to shear a sheep by hand, two-thirds as long with a hand-operated machine, and a little over half as long with a motor driven machine. The machine was driven by a 1/2 hp. motor and consumed 2.35 kw-hrs. per 100 sheep sheared." "Electricity on the Farm and in Rural Communities", Ibid., p. 283.

"The comparison of hand and machine milking in 1926 and 1927 showed a saving of 53.5 man hours of labor per cow when milking a 20-cow herd and was a saving of 47 per cent of the total labor required per cow." Hobert Beresford, "Rural Electrification Development in Idaho", Experiment Bulletin No. 180, Agricultural Experiment Station, Moscow, (April, 1931) p. 31.

"Electricity makes cooling and storage of milk on the farm easy. The milk may be cooled by running it over an aerator through which is pumped the cooling medium (clear water or brine solution) used in the storage tank, or cold water from the well. The milk is then stored in cans in the storage tank. A four-can size milk cooler was installed in the milk house on one of the farms. This milk cooler used an average of about 75 kw-hr. per month. It used as low as 4 kw-hr. per month during the winter and as high as 144 kw-hr. per month during the summer. A milk aerator and circulating pump was used in connection with the milk cooler. Before the milk cooler was installed, from one to three 10-gallon cans of milk were lost each month. There has been no losses since that time."

G. W. McCuen and I. P. Blauser, "Using Electricity on Ohio Farms", Extension Service, Bulletin 96, Ohio State University, Columbus, (May, 1937) p. 15.

"Several of the farmers stated that they saved enough by grinding their feed at home with the electric motor and grinder in place of taking it to town to a custom mill, to pay the cost of their entire electric bills, even though they were over $12 per month." "Using Electricity on Ohio Farms", op. cit., p. 16.

"A 5-hp. motor, mounted on skids, a 13-inch ensilage cutter, a tractor, a corn binder with conveyor type bundle carrier, three low down wagons, and a team of horses, made it possible for H.P. Miller & Son of Sunbury, Ohio, to fill the silos with a crew of four men. . . . They used a tractor to pull the binder and the wagon. One man operated the tractor and one man loaded the wagon. Another man with a team took the wagons back and forth between the field and the silo, and a fourth man fed the ensilage cutter and took care of everything about the silo." "Using Electricity on Ohio Farms", Ibid., p. 18.

"Electric Hotbeds. - The newest method of heating hotbeds, cold frames, and propagating benches is by the use of electricity. Although this method is relatively new, the results have been highly satisfactory, and many new installations are being made each year. . . . Less labor required for making and for care." "Using Electricity on Ohio Farms", Ibid., p. 21.

"Not only does the electric washer save labor but it also saves from one-third to one-half the time usually required for washing." "Using Electricity on Ohio Farms", Ibid., p. 9.

"The use of 5 and $7\frac{1}{2}$ hp. electric motors for silo filling is a common practice in many parts of the United States. . . . These tests show that a 5 hp. motor driving a good cutter, properly adjusted and at the correct speed, will cut and elevate four to five tons of corn an hour into a 35- to 50-foot silo, using approximately 1 kilowatt-hour of electricity for each ton cut. . . . Is easily started and stopped by means of a push button control. . . . Is automatically protected against careless operation. Requires only a one- or two-man crew for the complete job." R. R. Parks, "Electric Silo Filling", Extension Service, University of Illinois, Urbana, (January, 1940) p. 1.